



Exhibition overview

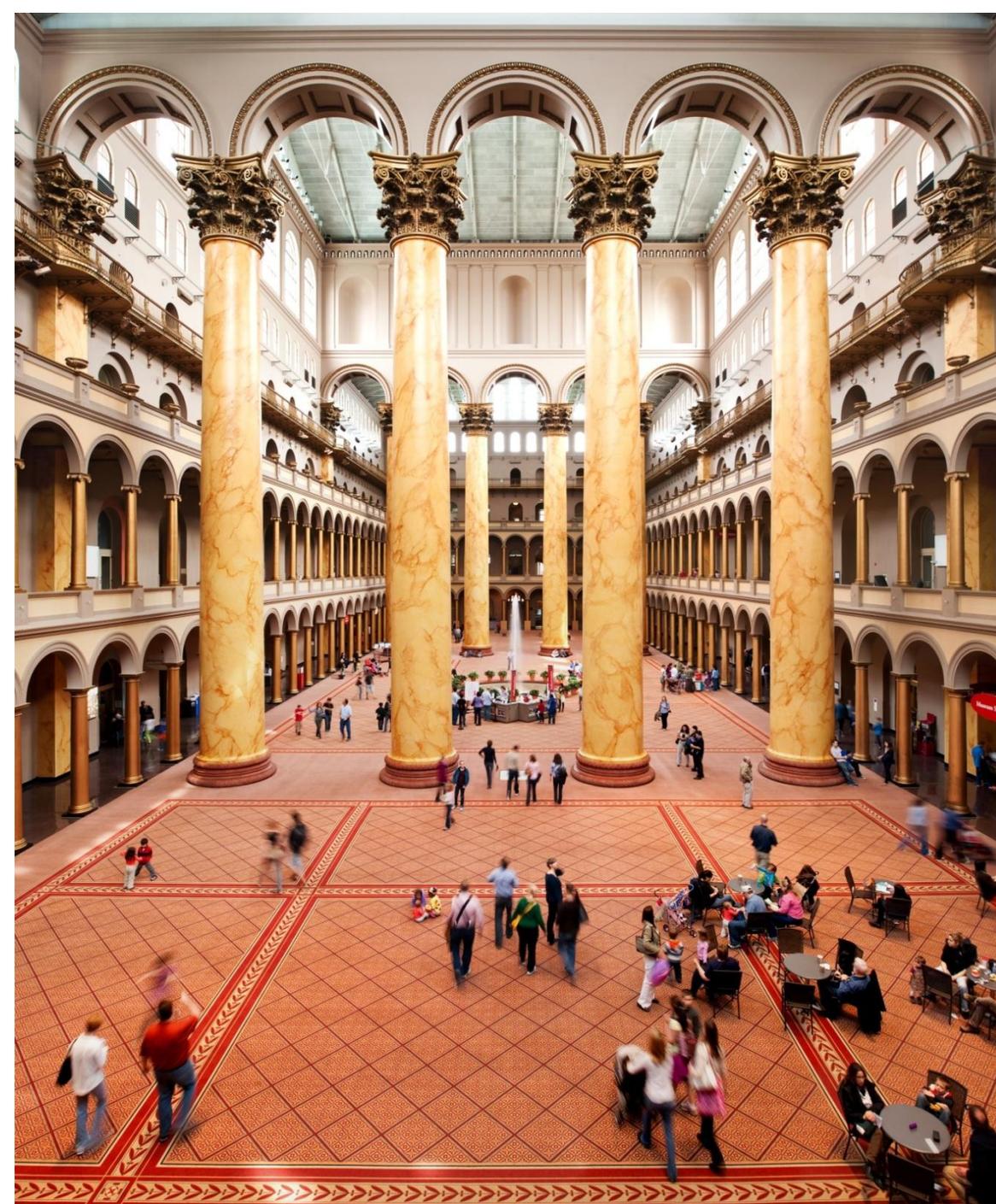
Designing for Disaster

May 11, 2014 through August 2, 2015

Chrysanthe Broikos, Curator

June 5, 2014





DESIGNING FOR DISASTER

From high-profile hazards such as earthquakes and hurricanes, to flooding, the nation's most frequent and widespread threat, the stakes could not be higher: lives, livelihoods, property, and the pursuit of happiness. As climate changes, infrastructure ages, and more of us settle in desirable but highly vulnerable coastal and forested areas, the human and financial costs attributed to these hazards are likely to rise.

Natural disasters—defining events for the communities and individuals directly affected by them—are reminders of Mother Nature's power. They are also warnings that alert us to potentially greater dangers, and drivers of change aimed at reducing long-term risks. Some become important national markers or even global watersheds.

This exhibition features mitigation projects from across the nation, all addressing efforts to prepare for, prevent, and reduce the impact of natural disasters *before they occur*. The scale and complexity is as varied as the solutions, from engineering bridges to dance, to protecting reservoirs with fire, to mobilizing people through interactive games. The message: We can *design for disaster*.

At every level, from family preparedness to federal policy, acceptable standards of safety and risk are being recalculated and redefined. Beyond survival, the aim is to increase our capacity to quickly and effectively respond and recover. Not simply to rebuild, or even rebuild better, but to build resiliency.

Natural disasters change lives. But even simple actions can save them.







HAZARD

MITIGATION

Mitigation is more demanding than simply rebuilding, it requires rethinking. And after a disaster, it sometimes runs counter to a community's desire to quickly return to normal.

Mitigation is the only preemptive phase of emergency management. Preparedness, response, and recovery, are essentially reactive. The Stafford Act, the federal law which authorizes the Federal Emergency Management Agency (FEMA), defines mitigation as "sustained actions to reduce or eliminate long-term risks to people and property from hazards and their effects."

Designed to break the cycle of disaster, rather than repeat it, mitigation can not only help save lives, protect property, and reduce losses, it can also help individuals, communities, and regions recover more quickly after a disaster. Mitigation translates into safer, more resilient communities. Even more compelling, every dollar invested in mitigation now, typically saves four dollars later. Despite all the positives, it can be a hard sell. Understanding the risks of inaction is often key.



PROBABILITY x VULNERABILITY)
PERFORMANCE

Hazard mitigation activities can take many forms. The case studies presented throughout the exhibition provide examples from three key categories:



Planning and Public Policy
Plan and prioritize hazard mitigation.
How: Conducting risk and safety plans.
Case Study: California's Hazard Mitigation Planning and Implementation Framework



Property Protection
Prevent damage, upgrading and retrofitting homes.
How: Mitigation design.
Case Study: Florida's Flood-Resistant Building Standards.
Case Study: Making communities and specific facilities, structures resilient.



Infrastructure
Protect critical infrastructure assets.
How: Regional, long-term projects and networks designed for disaster.
Case Study: Mitigation design.
Case Study: Rail and transit systems, communication infrastructure and daily life of citizens.
Case Study: Resilience and protection of essential services and things citizens rely on, from power, water, internet.



Public Information
Keep communities prepared for disaster.
How: Risk awareness and emergency awareness.
Case Study: Federal and local government communication and outreach efforts, nonprofit organizations.
Case Study: Federal helps public awareness campaigns, risk aware education.



Emergency Services
Keep preparing for disaster.
How: Mitigation design.
Case Study: Local emergency managers and the location of major facilities.
Case Study: Hazard monitoring, warning systems, emergency skills and education, drills, critical facilities protection.

DESIGNING FOR EARTH

The earth and the ground beneath us are in constant motion—but most of the time we don't feel it. Earthquakes, landslides, volcanoes, and the tsunamis that can follow remind us otherwise.

When it comes to mitigating the impacts of earthquakes, knowing your ground is critical. But the type of geophysics, including the study of ground shaking, fault rupture, and landslides, is often hard to come by. A seismic event, including earthquake mitigation an existing building, is the most.

Today, whether the solution features base isolation, bracing, restrained joints, moment frames, fluid viscous dampers, expansion joints, or other walls, for example, a structure's seismic performance is often just as much about accommodating and dissipating anticipated forces as it is about resisting them.

Many of the projects in this gallery feature the work of structural engineers as they use and combine new technologies and methods developed over the past 25 years—including those from two greater than 8.0 magnitude earthquakes, one in Los Angeles and the other in the San Francisco Bay area.

$$\text{RISK} = \frac{(\text{PROBABILITY} \times \text{VULNERABILITY})}{\text{PERFORMANCE}}$$

A property's likelihood of occurring—assessed via scientific analysis—helps predict how likely these risks are.

Number of people, type of strategic assets, and amount of property in harm's way
Mitigation can decrease vulnerability ↓

Integrity of our built assets and infrastructure and their capacity to perform during a hazardous event
Mitigation can improve performance ↑

DRILL TEAM



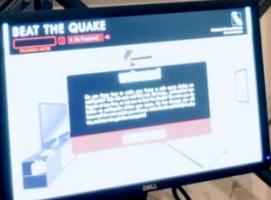
Earthquake Country Alliance
Southern California Earthquake Center, University of Southern California
Los Angeles, California

The Earthquake Country Alliance is making 'worst-case scenario' earthquake and tsunami planning real and relevant for millions. Their signature event, The Great California ShakeOut, is a simulation drill that coordinates emergency responders and community participants through scripted scenarios developed by the U.S. Geological Survey and the Federal Emergency Management Agency. The drill debuted in 2008 and has since spread to states and regions across the nation. The primary message: Drop, Cover, and Hold On, is a powerful reminder that simple actions, performed in a timely manner, save lives.

To help participants prepare for the ShakeOut, the Southern California Earthquake Center developed "Beat The Quake," an engaging online game that challenges players to correctly secure items in a typical family room before an earthquake hits. The game is a catalyst for families to discuss—and take—actions that increase the safety of their homes. More detailed preparedness guidance is available in a series of handbooks titled *Putting Down Roots in Earthquake Country*.



1 DROP! **2 COVER!** **3 HOLD ON!**



BRACING FOR IMPACT



BEAT THE QUAKE







BRACING FOR IMPACT



K. Inverted V: There's even a single diagonal "V" that connects corner to corner. Braced frames, part of an overall structural system, are usually made out of steel or concrete. They come in a variety of shapes and sizes. Their job is to resist the lateral, or side-to-side, movement of wind and earthquake forces. They can be used on a building's interior or exterior, for new construction or seismic retrofits.

Bracing increases stiffness and prevents the racking seen on the walls within this gallery. Bracing, diagonally stiffens and distorts a structure—often resulting in broken windows, cracked walls, and misaligned doors, if not worse.

Above, and behind these walls, is a full-scale example of a buckling restrained brace (BRB). This one takes the form of a regular, not inverted V and provides plenty of clearance.

The brace may look ordinary, but high-performance flexibility, known as ductility, is built into it. It represents one of the latest advancements in seismic protection.



BRACING TYPES:

- Standard V-Brace:** A diagonal member connects two corners of a rectangular frame, providing lateral resistance.
- Inverted V-Brace:** A diagonal member connects the midpoints of two opposite sides of a rectangular frame.
- Buckling Restrained Brace (BRB):** A central diagonal member is encased in a steel tube, allowing it to buckle under compression without losing strength.



More than just a
pretty brace.

Courtesy Gonzalez Goodale Architects, @helipho.net

In California, the City of Pasadena's Water & Power Operations Building uses innovative buckling restrained braced frames (BRBF) that are engineered to stretch and bend to resist earthquake forces.

Visit *Designing for Disaster* at the National Building Museum to learn more about how design can save lives. Opening May 11.

DESIGNING FOR DISASTER

Designing for Disaster is sponsored in part by:



Judiciary Square Metro | www.nbm.org

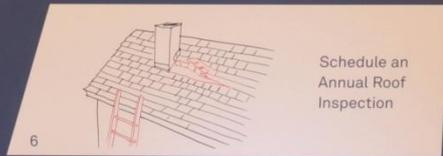
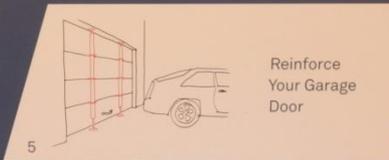
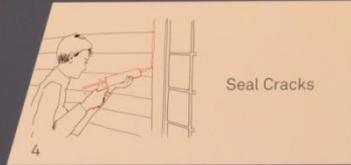


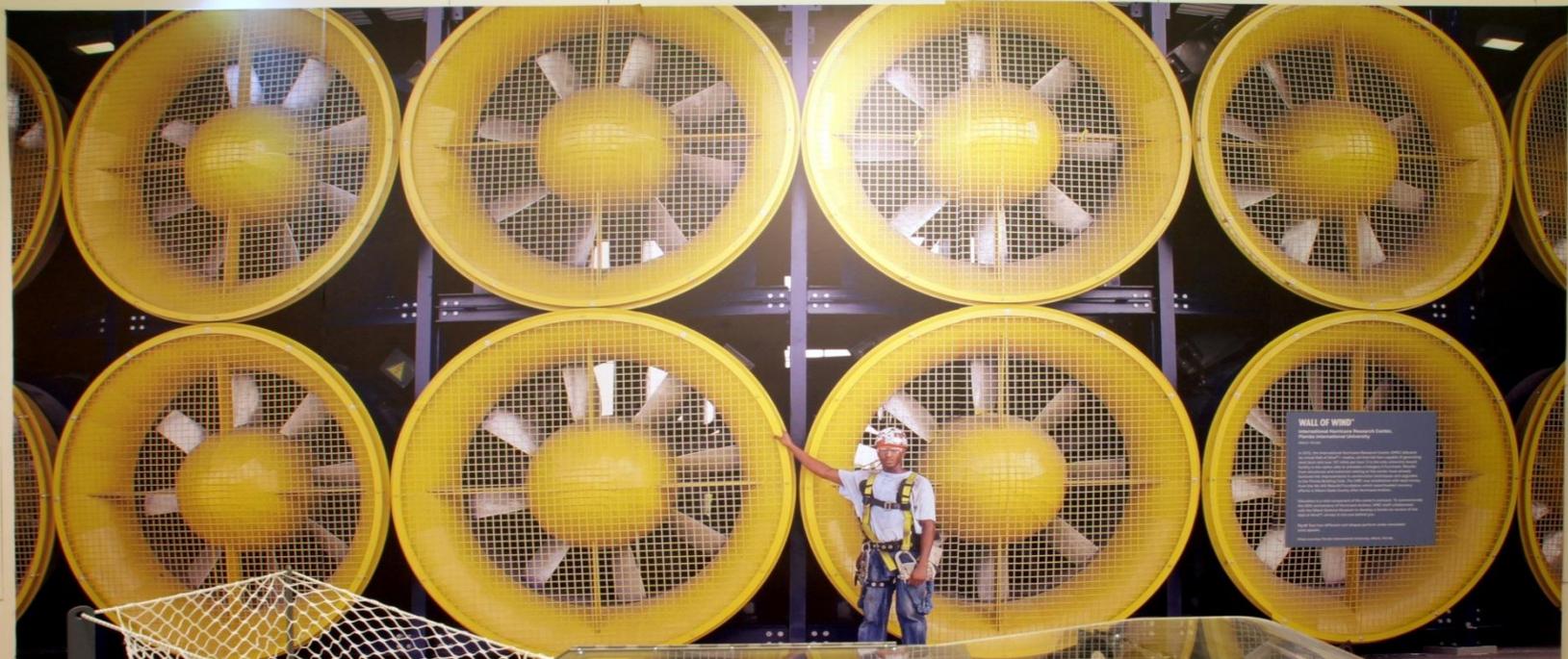
WHAT CAN YOU DO?



Here are some practical steps you can take to ensure your safety before a **TORNADO** or **HURRICANE**.

1. Make an emergency plan for you and your family—and practice.
 - Identify the safest place to ride out the storm.
 - Be familiar with evacuation routes in your area.
2. Keep and maintain an emergency preparedness kit or "go-bag" in an easy-to-access location.
3. Clear or secure objects in your yard that could become projectiles such as patio furniture and playground equipment.
4. Seal cracks around your doors, windows, and any gaps in outer walls with caulk.
5. Reinforce your garage door with vertical aluminum braces.
6. Schedule an annual inspection of your roof. Make sure any loose shingles are secured.
7. Install storm shutters or impact-resistant doors and windows.





WALL OF WIND
Experience the power of wind in a hands-on way. This exhibit features a wall of large fans that create a strong breeze. Visitors can feel the wind and see how it affects objects in the wind tunnel. The exhibit is designed to educate visitors about the science of wind and its impact on buildings and structures.

How do they work?
The fans are powered by a system of belts and pulleys. The fans are arranged in a grid pattern, and the wind is directed through a series of ducts. The exhibit is designed to be interactive, allowing visitors to see how the wind affects objects in the wind tunnel.






FORTIFIED





DESIGNING FOR WATER

Flood. Storm surge. Tsunami. Sea level rise. Water is dynamic and invades us from all directions. The scale and scope of the threat continue to increase as new problem areas—often created by development patterns that alter natural water retention and run-off—join traditionally vulnerable river cities and coastal communities.

Current thinking in water hazard mitigation includes restoring elevated natural systems. Whether it's retreating altogether, "making room for the river," elevating structures, or creating living shorelines, these tactics adapt to the ebb and flow of the waters. Even the U.S. Army Corps of Engineers, without abandoning conventional flood controls, is investigating nature-based infrastructure as well as strategic retreat.

Federal flood mitigation efforts include the National Flood Insurance Program, which subsidizes coverage in communities that have adopted minimum flood reduction protections. More comprehensive floodplain management is incentivized through premium discounts.

Redefining the water's edge as a fluid boundary that connects the environment, infrastructure, and public amenities brings architects and landscape architects new opportunities to change the way we live with nature.

DESIGNING FOR FIRE



RESTORING COASTAL RESILIENCE



Long committed to preserving and restoring coastal habitats, the Nature Conservancy has drawn attention to the critical role oyster reefs play in healthy ecosystems.



MISSISSIPPI RIVER HIGH WATER MARKS



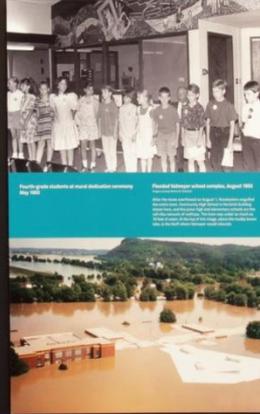
MOVING TO NEW HEIGHTS

Relocating Valmeyer, Illinois

The Great Flood of 1993 left devastation in its wake as it moved down the Mississippi River. The disaster affected nine states and was the nation's costliest flood, with an estimated \$15 billion in damages and victims numbering in the tens of thousands.

In one small farmland community in Southwestern Illinois, the Mississippi ravaged 90 percent of the buildings. After the levee broke—and with it, all else—the 900 residents of Valmeyer faced a choice: remain or relocate. Staying would have meant rebuilding and likely elevating most structures. Under Valmeyer's brave leadership, residents made the practically unprecedented decision to relocate the entire town and rebuild out of harm's way.

By 1995, the first residents had moved. The new site, a nearby bluff top, is 300 feet higher and free from any history of flooding. With the help of \$25 million in federal and state money for town infrastructure and schools, the town began a three-year rebuilding process. Today, Valmeyer is home to more than 1,200 residents.



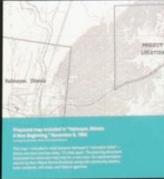
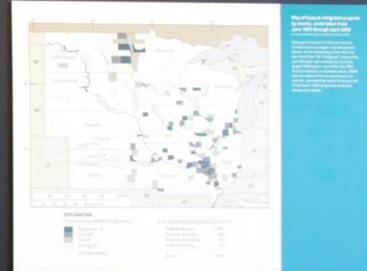
Fourth grade students at school relocation ceremony May 1995

Mayor Valmeyer school grounds, August 1995



Planning Valmeyer

Rebuilding and relocating Valmeyer 1995



Valmeyer, Ill., was completely destroyed by the Great Flood of 1993. The town was relocated to a nearby bluff top, 300 feet higher and free from any history of flooding. With the help of \$25 million in federal and state money for town infrastructure and schools, the town began a three-year rebuilding process. Today, Valmeyer is home to more than 1,200 residents.



MITIGATION NATION

Discover a part of the Mitigation Nation, learn the problems and challenges they face and the ways they've found to overcome them. Meet the people who are making a difference in their communities.



Share your story and find inspiration at www.mitigationnation.org



WHAT CAN YOU DO?

Create a kit bag

All the best ways to prepare for a disaster. Get the most out of your kit bag by making sure you have the right supplies. Check out the list of items to include in your kit bag and see how you can make it work for you.

